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Has received an application for a patent for a new and useful invention. The title and description of the invention are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the invention shall be granted under the law.

Therefore, this

United States Patent

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Bruce Lehman

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US005600445A

United States Patent [19][11] **Patent Number:** **5,600,445****Omi**[45] **Date of Patent:** **Feb. 4, 1997****[54] MODULAR COPYING SYSTEM USING
LIGHT WAVE, ELECTRIC WAVE, OR SONIC
WAVE INTERCONNECTIONS****[75] Inventor:** Kyoji Omi, Kawasaki, Japan**[73] Assignee:** Ricoh Company, Ltd., Tokyo, Japan**[21] Appl. No.:** 215,608**[22] Filed:** Mar. 22, 1994**[30] Foreign Application Priority Data**

Mar. 23, 1993 [JP] Japan 5-089351

[51] Int. Cl.⁶ **H04N 1/00; H04N 1/40;**
G03G 21/00; G01D 15/00**[52] U.S. Cl.** **358/296; 358/401; 358/443;**
346/145; 399/1**[58] Field of Search** 358/296, 300,
358/401, 442, 443, 468, 471, 474; 355/200,
202; 347/3, 108, 138, 145, 152, 170, 222,
245, 263; 346/145; 395/114**[56] References Cited****U.S. PATENT DOCUMENTS**

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Primary Examiner—Peter S. Wong*Assistant Examiner*—Eric Frahm*Attorney, Agent, or Firm*—Oblon, Spivak, McClelland,
Maier & Neustadt, P.C.**[57] ABSTRACT**

A modular copying system including combinations of printer, scanner, and system controller modules formed as independent frames. The scanner module includes devices for image reading, first data I/O and first synchronizing signal generation; the printer module includes devices for image forming, second data I/O and second synchronizing signal generation; and the system control module includes devices for third data I/O and system control. The modules are added or removed according to user requirements and the system is capable of accommodating up to seven modules. The modules are stacked in a vertical direction and arranging devices ensure proper module alignment. Once the modules are aligned and assembled in the system, communications between each module is accomplished via light wave, electric wave, or sonic wave transmission and reception. As a result, system interconnection is reduced, system noise is reduced and various connecting cables are eliminated. In addition, the system can be connected to a public ISDN line for transmitting detected system faults to the factory and for receiving fault diagnosis information which is displayed to a user via a display. Further, the system is capable of performing various image processing functions, such as processing with a space filter, image size conversion, image-trimming, image movement, color image trimming, color correction, and tone conversion.

11 Claims, 25 Drawing Sheets